

A CLYMENIID FROM THE *WOCKLUMERIA* ZONE OF NEW SOUTH WALES

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ABSTRACT. A new species of clymeniid, *Cymaclymenia borahensis*, from the *Wocklumeria* zone of New South Wales, is described, and its stratigraphical significance discussed. This is the first clymeniid described from Eastern Australia.

IN north-eastern New South Wales, Upper Devonian and Lower Carboniferous rocks consist of a series of geosynclinal sediments, chiefly mudstones, which outcrop in a trough along the western edge of the area, and in a few places along the coast, north of Newcastle. On the western side of the western trough marine faunas of Lower Carboniferous age are well known, but to the east of this trough, in a deeper water environment, fossils are rare. Consequently, any fossils which provide bases for accurate correlation, both within the area and with overseas sequences, are extremely valuable. It has never been possible to define the Devono-Carboniferous boundary in this sequence, due chiefly to the lack of Devonian marine faunas.

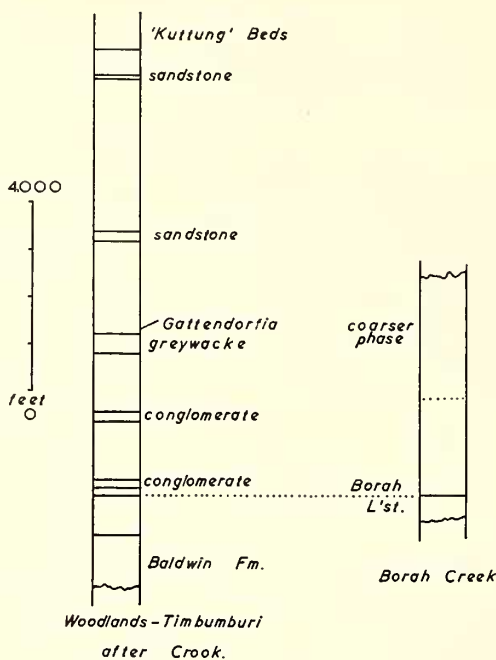
STRATIGRAPHY

The Borah Limestone, in the type locality, is in an incomplete section, but farther south, where it contains fossils only rarely, it can be located in a complete sequence examined by Dr. K. A. W. Crook. Beneath the limestone at the type locality is little more than 50 feet of banded mudstone, with abundant *Leptophloeum australe*. This is absent from the mudstones which overlie the limestone. These mudstones are 200 feet thick and pass up into a coarser phase, in which fine arenites showing graded bedding are the dominant lithological types. This sequence is then truncated by a fault, so that the only known fossil horizons in the sequence are the limestone itself, and the *Leptophloeum* beds. The nature of the limestone is so distinctive that correlation from this locality farther south is quite positive. It is a fine-grained, blue-grey limestone, weathering whitish, containing recrystallized radiolarian tests, and euhedral crystals of an unknown mineral, which has been replaced by a mosaic of albite and calcite. These pseudomorphs, which occur in bands, and are whitish, in contrast to the blue-grey of the limestone, make it an extremely distinctive rock. The outcrop extends for almost 50 miles south-south-east from the type locality, which is the most northerly known outcrop.

This section includes rocks which would belong to the 'Barraba Series' in the lower part, and 'Burindi Series' (of Browne 1950) in the upper part, but it is impossible to make a division, as the boundary of these two has never been defined in a continuous sequence on the eastern side of the trough. The terminology of this interval is at present under review.

Crook's section, in the south, runs in a conformable sequence from low in the Upper Devonian to the Middle Carboniferous. Above the generally unfossiliferous Baldwin Formation is a thick sequence of marine mudstones, with members of limestone, con-

glomerate, greywacke, and sandstone. Some 800 feet above the top of the Baldwin Formation is a limestone with which the Borah Limestone has been correlated. Here, as in the type section, *L. australe* occurs below the limestone, and is not known above it. The *Leptophloeum* extends down into the Baldwin Formation, but is most abundant beneath the limestone. A few feet above the greywacke member (see text-fig. 1) Crook reports a specimen of *Gattendorfia*, which has been identified tentatively, by Crook, as



TEXT-FIG. 1. Stratigraphical columns.

G. minusculum Miller and Collinson, but as the specimen has since been destroyed by a fire this cannot be checked. In America this species occurs in the Northview Shale, of approximately Middle Tournaisian age. Indirectly, through the Northview Shale, this could be correlated with a fauna containing *Protocanites lyoni* (Meek and Worthen), on the western side of the trough in this area.

Above 11,000 feet of these marine mudstones a series of terrestrial, volcanic, and glacial sediments is developed, the 'Kuttung Series' of Browne. It contains plant fossils in places, chiefly *Rhacopteris*. The Tournaisian-Viséan boundary is probably very near this transition from marine to terrestrial sedimentation.

In Catong Gully, north of Somerton, a goniatite which appears to be *Platyclymenia* was collected with specimens of *Leptophloeum australe*. This specimen shows one doubtful suture, and it proved impossible to develop any. The coiling and ornament are quite like that of *Platyclymenia* (see Pl. 41, fig. 7). Unfortunately, the higher part of this section is covered by high-level gravels associated with an earlier stage in the history of the Peel River; as well as this, faulting prevents extrapolation along the strike, so that the relation of this occurrence of *Platyclymenia* to the limestone cannot be determined.

There would be at least 300 feet of sediment between this and the overlying Borah Limestone.

SYSTEMATIC PALAEOONTOLOGY

Genus CYMACLYMENIA Hyatt 1884

Cymaclymenia borahensis sp. nov.

Plate 41, figs. 1-6.

Holotype. Specimen No. F4599, University of New England collections. *Paratypes*. Specimens No. F4600, F4602, University of New England collections. All specimens from type locality (L200, U.N.E. catalogue) on south bank of Borah Creek.

Description. The conch is moderately involute, less so in younger whorls, and platyconic. The whorl height increases markedly in later volutions. The maximum number of



TEXT-FIG. 2. Suture of *Cymaclymenia borahensis* sp. nov.

whorls probably does not exceed six. The largest specimen has a maximum diameter of 5.5 cm., and the smallest does not exceed 1 cm., although four whorls are developed. Decoration consists of growth-lines only, fine lirae parallel to the aperture, with a fairly deep, smooth sinus across the venter, and a pronounced ventro-lateral salient. No radial ribs are present. The whorl profile changes during growth, and at maturity is rather similar to that of *C. striata*. The outer whorl is higher than the inner whorls, with tapering sides, and is much less involute. On a mature test, the height of the last whorl is slightly less than half the total conch height.

The suture has a very broad ventral lobe, with a broad, shallow, secondary ventral saddle. The first lateral saddle is well developed, rounded, and the lateral lobe is strongly asymmetrical, with an inflected point on the ventral side. The second lateral saddle is flat, gradually receding into the shallow umbilical lobe, divided by the umbilical seam.

Discussion. *C. borahensis* is more like *C. barbarae* (Loewinson-Lessing) than any of the other species, particularly in regard to the suture. However, Loewinson-Lessing's stratigraphy in the original work is not completely clear. He did not collect the specimens himself, and although he places the fauna in the 'zone of *Sporadoceras münsteri*', it is possible that at least two zones are represented. The only completely reliable report of *C. barbarae* is that of Schindewolf (1952) from Saalfeld, from the *Wocklumeria* zone. The suture of *C. borahensis* is even closer to this than to that of Loewinson-Lessing's specimens.

The two other described species without radial ribs differ from *C. borahensis*, mainly in the degree of development of the first lateral saddle. *C. striata* has a rather similar whorl profile, but the lateral salients are less well developed. *C. camerata* differs in the

whorl profile, though the suture is less different. These two species both occur in the *Clymenia* and *Wocklumeria* zones, so that this, together with the similarity to *C. barabae*, suggests that *C. boraliensis* belongs most likely to the *Wocklumeria* zone.

	<i>Platyclymenia</i>	<i>Clymenia</i>	<i>Wocklumeria</i>
<i>C. striata</i> (Münster)		×	×
<i>C. costata</i> (Wedekind)	×	×	
<i>C. evoluta</i> (Phillips)			×
<i>C. ornata</i> (Münster)		×	
<i>C. barabae</i> (Loewinson-Lessing)	?	×	×
<i>C. cordata</i> Wedekind		×	
<i>C. camerata</i> Schindewolf		×	×
<i>C. ovata</i> Schindewolf		×	
<i>C. boraliensis</i> sp. nov.			×
<i>C. dorsocostata</i> (Münster)		?	

Ranges of *Cymaclymenia* species.

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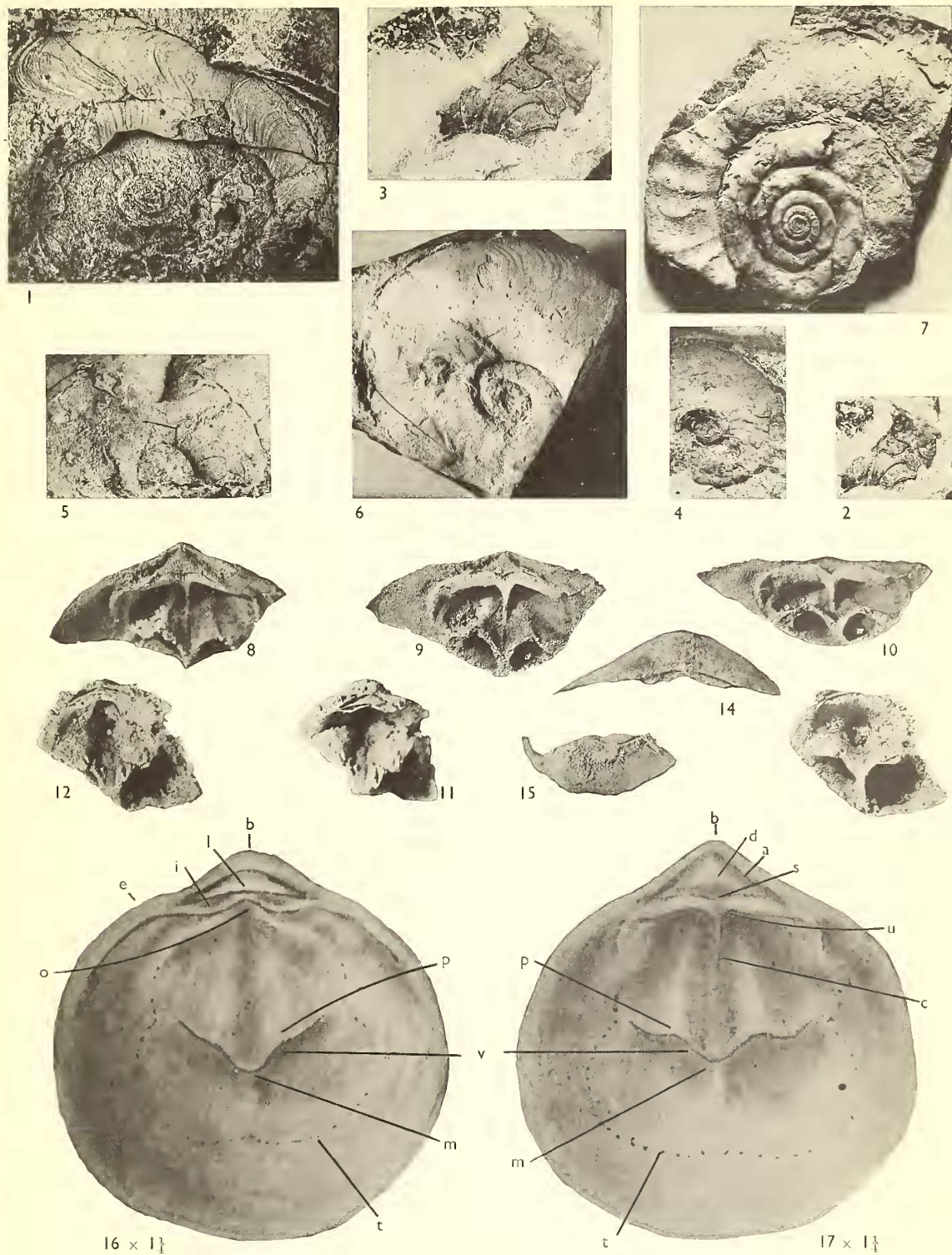
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EXPLANATION OF PLATE 41

Figs. 1-6. *Cymaclymenia boraliensis* sp. nov., Borah Limestone, Borah Creek. 1, Paratype, F4600, showing aperture and growth lines, $\times 1$. 2, 3, Holotype, F4599, showing sutures; 2, $\times 1$; 3, enlarged. 4, Sutures and part of living chamber, F4601, $\times 1$. 5, Youngest suture and part of living chamber, F4603, $\times 1$. 6, Paratype, F4602, showing umbilicus, growth lines, and part of living chamber, $\times 1$.

Fig. 7. ?*Platyclymenia* sp., Upper Catong Gully, Attunga; F4618, $\times 1$.

Figs. 8-17. *Dinobolus* sp. cf. *D. conradi* (Hall), Sandpile group, British Columbia. 8-15 are unretouched photographs, $\times 1$; 16, 17 are drawings illustrating the terminology, $\times 1\frac{1}{4}$. 8, 11, Internal views of the incomplete pedicle and brachial valves, Geol. Surv. Canada 14487. 9, 10, 12, 13, Internal views of the same valves tilted; 9, 10, pedicle valves, 12, 13, brachial valves. 14, 15, Posterior views of the pedicle and brachial valves. 16, 17, Reconstructions of the complete brachial and pedicle valves (outlines and anterior parts adapted from Davidson and King 1874). *a*, groove; *b*, beak; *c*, cardinal buttress; *d*, pseudodeltidium; *e*, cardinal partition; *i*, cardinal impression; *l*, plate; *m*, median partition; *o*, subcardinal impression; *p*, platform; *s*, cardinal socket; *u*, umbonal chamber; *v*, platform vault; *t*, position of trace of anterior part of crescent.



PICKETT, Clymeniids from Australia
NORFORD, *Dinobolus* from British Columbia